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CLOSING ADDRESS

BEFORE THE

Metropolitan Mechanics' Institute,

BY

PROFESSOR JOSEPH HENRY,

ON

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ADDRESS.

At the close of the Exhibition of the Metropolitan Mechanics' Institute, it becomes my duty to offer some remarks relative to the objects and organization of the Association; and, in addition to these, I shall beg leave to call your attention to some points which present themselves more prominently to my mind, amidst the extended field of the history of mechanical inventions.

The object of this institution is twofold: First—The improvement of mechanics and artists. Second—The improvement of arts and inventions.

These two objects are inseparably connected, and the one necessarily follows as a consequence of the other. Whatever tends to develope the mind of the workman, tends to advance the condition of his art. Every material operation, and every invention, is founded on some law of Nature; and the more intimately the operator is acquainted with the principles of his art, the better is he fitted to improve it. Without a knowledge of science, the practice of art is mere empiricism—often involving operations which are not only unnecessary to the production of the desired result, but frequently detrimental.

The savage who recovers his health after drinking from a mineral spring, considers his cure due not alone to the efficacy of the water, but also to the position of his body at the time of drinking, whether facing the East or the West, to the number of draughts, and perhaps, in some cases, he deems it necessary previously to propitiate the spirit of the fountain by a sacrifice of some object of value. We need not go to savage life for examples of this kind. In many parts of our own country—even among men otherwise intelligent—certain mechanical and agricultural operations are connected with superstitious observances of the most ridiculous and inconvenient character. A knowledge of principles serves to eliminate these errors, to point out the necessary and essential conditions of practice, and to facilitate the introduction of improved methods. On the other hand, every improvement in the mechanic arts, as a general rule, tends to elevate the character of the artizan, and to render his employment more intellectual.

It is proposed in this institution to improve the workman by lectures, collections of specimens of Natural history, a library, and a reading-room; and to advance the arts by exhibitions, and by the examination of such new inventions as may be submitted to the judgment of the Institute. For conducting this part of the plan of operation, a permanent Committee of Science and Arts will be formed, combining amongst its members theoretical knowledge with practical skill.

There is no place in the United States, in proportion to the number of its mechanics, so well adapted to support an efficient institution of this kind as the City of Washington. It offers numerous examples of ingenius inventions and processes. The models of the Patent Office, the instruments of the Observatory, of the Coast Survey, of the Topographical Bureau; the processes of the Navy Yard and of the Arsenal are illustrations of the useful arts readily accessible and of the most instructive kind. Moreover, no city of the Union of the same size can command so large a number of scientific men—namely, those belonging to the Army and the Navy, and the institutions established here. Any association which tends to bring these into harmonious co-operation with the practical mechanics of the place, may, and I doubt not will, be productive of important results.

The Institute has commenced its existence under very auspicious circumstances, and has found favor with the wise and the liberal. Notwithstanding this, the enterprise is not unfraught with danger; and those who were instrumental in establishing it, assumed a responsibility of no small weight. They evoked a power which may be determined on good or on evil; which, while it is capable of conferring blessings on this city and this country, may be the means of propagating error, and of administering to the selfish ends of designing men. There is no city in which a society of this kind requires to be more strictly guarded against baneful influences. The partizan politician may attempt to make it the stepping-stone of his political advancement. The pseudo inventor, who seeks to enrich himself by pirating the labors of humble and unobtrusive genius; and the speculator, who wishes to impress Congress with the importance to the country and to the world of a scheme intended to benefit himself alone, will be untiring in their endeavors to obtain the certificates and recommendations of the Institute. They will approach its judges and its committees with soft words and insinuating manners, and will not hesitate to offer bribes in such sophistical terms, that, while the cupidity is excited, the conscience is lulled to rest.

The location of this institution at the seat of government of this vast Union, will turn all eyes upon it, and will consequently tend to give it corresponding power and influence. But it must be recollected that, in proportion to the conspicuousness of the position occupied by institutions or individuals, is their responsibility to society increased. The higher they stand the more secure must be the principles on which they are supported. When men build upon a false foundation, the greater their elevation the more certain is their fall.

There is no place in this country where *motives* and *acts* are more critically examined than in the City of Washington. There is none in which *capacity*, *honesty of purpose*, and a *prudent*, *straight forward course* are more necessary to continued success, and none in which *deviations* from *right*, whether intentional or otherwise, are more readily detected and exposed.

The mere organization of the institution, however well it may have been done, is not sufficient for its perpetuity and usefulness. It requires the constant application of individual effort to sustain it; the unwearied labor of a few master spirits to infuse the constant supply of vital energy; and these must be men of high moral principle, not only strictly honest, but above suspicion of the contrary. They owe a strict accountability to the members of the Institution for the manner in which the income is expended, and to the world for the mode in which the high duty of acting as judges of the merit of inventions has been discharged. The task of the judges, and of the Committee of Science and the Arts, to whom discoveries and inventions are referred, is one of delicacy and difficulty, and should not be entrusted to those unacquainted with the principles on which the proposition to be examined depends, or who do not possess the mental and moral qualifications necessary to the formation of a correct judgment. It is for the benefit of the community that the truth should prevail, and that the merits and defects of an invention should be rendered distinctly manifest. Where merit exists it should receive due credit, but not exaggerated praise. The simple statement of what has been accomplished, is all that is needed, though it may not be all which a generous spirit is impatient to bestow. Nobleness of mind springs forward with ardor to meet every indication of a similar kind wherever it appears. The whole duty, however, in this case, may be expressed in two words—*strict justice.* This is what every judge ought to give, and more than this no man ought to wish to receive.

It will often become the duty of the committee of examination of subjects of science and arts to repress the premature zeal of visionary inventors. We need only examine the records of the Patent Office to be convinced of the immense expense of time and money continually lavished on futile attempts to innovate and improve. We may safely venture to affirm that out of every fifty propositions for improvements in arts or mechanics, forty-nine, at least, are either useless or old. The object should be to distinguish and to adopt the good and reject the bad. But while pruning the luxuriant fruit of uncultivated invention, care must be taken to perform the task with gentleness, and to show that the intention is to give additional vigor to the healthful branches and not to injure the parent plant.

There can be no reality in science, if at this late day it cannot predict that certain proposed inventions are impossible, as well as declare that others are in accordance with established principles. An honest expression of opinion on such points, though it be met with the accusation of repressing the march of improvement, is necessary in order to save the public from having its attention perpetually distracted by the excitement of fallacious expectations, and the credulous from embarking their all in schemes which must end in disappointment and ruin.

One of the most fruitful sources of error and deception with regard to inventions, arises from misconceptions of the nature and application of mechanical power; and this is one of the points on which I wish to arrest your attention for a few minutes. We understand by the term mechanical power, that which moves machinery, transports heavy bodies, shapes the raw material into useful forms, and to use the short but expressive phrase of the mechanic, "*that which does work.*" Mechanical power, when properly understood, is a condition or state of matter. Thus, a quantity of burning fuel, a moving mass of water or of air, are bodies in the condition of power, and, by communicating a portion of their motion to other bodies, they produce in them certain changes which are denominated *work.* The change thus produced is the measure of the amount of power in a given quantity of matter. For example, the number of bushels of grain which can be ground during the combustion of a bushel of coal, is the measure of the amount of power in this quantity of fuel.

Power is always expended in doing work, and it is in the highest degree absurd to think of applying it to useful purposes without exhausting it. Every change of condition, every transformation of matter, every new motion, and every manifestation of life, is at the expense of some motive power which, having performed its part, is forever neutralized.

Power is always the product of Nature. God has not vouchsafed to man the means of its primary creation. It is found in the moving air and the rapid cataract—in the burning coal—the heaving tide; man transfers it from these to other bodies and renders it the obedient slave of his will—the patient drudge which, in a thousand ways, administers to his wants, his convenience, and his luxuries, and enables him to reserve his own energy for the higher purpose of the development of his mind and the expression of his thoughts.

The following is a list of all the primary powers which, as yet, have been used by man in accomplishing his varied purposes in the wide domain of practical life. These are:

1. Water power,
2. Wind power,
3. Tide power,
4. The power of combustion, and
5. The power of vital action.

To this list may hereafter be added the power of the volcano and the internal heat of the earth; and, besides these, science at the present time gives no indications of any other. These are denominated primary powers, though, in reality, when critically studied, they may all, except the two last mentioned, be referred to actions from without the earth, and principally to emanations from the sun.

Gravitation, electricity, galvanism, magnetism, and chemical affinity, can never be employed as original sources of power. At the surface of the earth they are forces of quiescence, the normal condition of which must be disturbed before they can manifest power; and then the work which they are capable of performing is only the equivalent of the power which was communicated to them.

There is no more prevalent and mischievous error than the idea that there is, in what are called the imponderables, a principle of spontaneous activity. Heat is the product of chemical action; and electricity only manifests power when its equilibrium is disturbed by an extraneous force, and then the effect is only proportional to the disturbing cause. It was for this reason that the existence of electricity remained so long unknown to man. Though electricity is not in itself a source of power, yet, from its extreme mobility and high elasticity, it affords the means of transmitting power with scarcely any loss, and almost inconceivable velocity, to the greatest distance. A wave of disturbance, starting from the impulse given at the battery, will traverse the circumference of the earth in less time than I have been occupied in stating the fact.

Besides electricity and the principles before mentioned, there are other agents employed between the primary power and the *work*—namely, the elastic force of steam, of air, and of springs; also, various instruments called machines. But these must not be confounded, as they frequently are, with the sources of power. It is not the engine which is the source of motion of the cars, nor yet the steam, but the repulsive energy imparted to the expanding water from the burning fuel.

A machine is an intermediate instrument to transmit, to modify, and to apply power; and, with the exception of the power consumed in wearing away the rubbing parts—that is, in producing friction, and the small portion imparted to the air, the amount of power transmitted is just equal to that received.

The human body is itself an admirably contrived complex machine, furnished with levers, pulleys, cords, valves, and other appliances for the application and modification of the power derived from the food. It is, in fact, a locomotive engine, impelled by the same power which, under another form, gives activity and energy to the iron horse of the railway. In both the power is derived from combustion of the carbon and hydrogen of the organic matter employed for food or fuel. In both the direction of power is under the influence of an immaterial, thinking, willing principle, called the soul. But this must not be confounded, as it frequently is, with the motive power. The soul of a man no more moves his body than the soul of the engineer moves the locomotive and its attendant train of cars. In both cases the soul is the directing, controlling principle, not the impelling power. Let, for example, a locomotive engine be placed upon the track, with water in the boiler and fire in the grate—in short, with all the potentials of motion, and it will still remain quiescent. In this state, let the engineer enter the tender and touch the valve, the machine instantly becomes instinct with life and volition—it has now a soul to govern its power and direct its operations: and, indeed, as a whole, it may be considered as an enormous animal, of which the wheels and other parts are additions to the body of the engineer.

The facts I have given as to the source of power and its application, rest upon the widest and best-established inductions of physical science; and a knowledge of them is absolutely essential to every one who desires to improve the art of applying the powers of the elements to useful purposes. And yet, if we are to judge from the constant announcement in the papers of new motors, of machines moved by centrifugal force, of engines to do a large amount of work, with the expenditure of an infinitesimal quantity of power, of contrivances by which electricity is to develop itself and do work by its own force, we shall be convinced that, on projects which are in opposition to the best-established truths of science, hundreds of thousands of dollars are squandered, and years of thought and labor wasted. One cause of error of this kind is the unfortunate name which was originally given to, and is still retained by, certain elementary machines—viz: the lever, the wheel and axis, the inclined plane, the pulley, and the screw. These are employed, separately, as instruments for the application of power, or in combination, as the elementary parts of complex machines. Every tyro in science knows that they have no power in themselves; yet the name, *mechanical powers*, by which they are designated, tends to perpetuate a pernicious error long after the fallacy is understood.

A machine, as I have before stated, is an instrument to apply and modify power, and to effect changes in the form and texture of matter, denominated *work*. The combination of the elementary parts of machines, so as to produce any desired motions, has been studied with much success, and the whole reduced to rules. The diffusion of a general knowledge of these would much facilitate invention and prevent the necessity of the individual who devotes his mind to the improvement of machines beginning anew instead of building on what has been done before him.

Every complex machine consists of parts which may be classified as follows:

1st. The receivers of the power—such as the buckets and other parts of the water wheel; the vane of the windmill.

2d. The transmitters and modifiers of the motion, viz: wheels, pinions, levers, pistons, screws, &c.

3d. The supporters—such as the frames, the friction rollers, &c.

4th. Regulators to render the motion uniform.

5th. Operators or parts applied immediately to the matter on which the work is to be done.

The preparation and publication of charts of the elementary parts of machines and their combinations would do important service to the practical mechanic, and is an object among many others worthy of the attention of this Institute.

The most important source of mechanical power among those we have mentioned, and which promises almost to supersede all others, is that of burning coal. This material, like a watch wound up, is matter in a state of power, or in a state of unstable equilibrium, ready to rush into combination with the oxygen of the atmosphere as soon as the initial action is given, and to evolve power in the form of heat until the whole is consumed. It has been proved that, on an average, *four ounces* of coal is sufficient to draw, on a railway, one ton a mile. It has also been found by experiment that a man working on a tread mill continuously for eight hours, will elevate one and-a-half million of pounds one foot high. Now, good Cornish engines will perform the same work by the expenditure of the power of a pound and a half of coal. It follows from these data that about five tons of coal would evolve as much power during its combustion as would be equal to the continued labor of an able-bodied man for twenty years, at the rate of eight hours per day; or, in other words, to the average power of a man during the active period of his life. Providence has, therefore, stored away, in the form of coal, for the use of man, an incalculable amount of mechanical power. Beneath the soil of our own great coal basins there reposes power equivalent to the united force of myriads of giants, ready, like the genius of Aladin, to be called into activity by the lamp of science, and, as its obedient slave, to build cities, to transport palaces, or remove mountains. There is no other locomotive power over which man has any prospect of control in the least degree comparable with this.

I have made these remarks with reference to power, because mistakes on this subject are so frequent and so fatal. Allow me, in the next place, to call your attention to some other points having a direct bearing upon the progress of the mechanic arts.

In order that an important invention may be successful, two conditions must be favorable. First, It must be possible—that is, the scientific principle on which it is to be founded must be known. Second, The invention must be wanted; or, in other words, it must be called for by the character and intelligence of the times, or rendered especially desirable in a particular place by some peculiarity of climate, topography, &c.

With reference to the first position, it may be said that, in accordance with the well-known laws of permutation, an almost infinite number of new combinations or inventions may be formed from the present stock of scientific knowledge. This is true; but the inventions thus produced must be restricted as to kind; and though they be unlimited in number, they are not so as to character. No combination of known principles, before the discovery of galvanism, was sufficient for the invention, by the most ingenious synthetical mind, of the electro-magnetic telegraph; but, after the discoveries made by Galvani and Oersted, this invention became possible.

In the history of the progress and development of a branch of science, a condition is reached when its principles become applicable to some practical purpose; and it is instructive to observe how, at this period, it suddenly assumes in the public mind a high degree of importance. The man who makes the application, though he may not have spent a tithe of the labor and thought on the subject which was bestowed on it by those who brought it to its practical state, is crowned as the discoverer of the whole. After this, however, competitors arise who claim a share of the reward, if not the honor of the invention. These labor to show that the first inventor derived his ideas from the discoverers. The public mind then takes another turn, and is disposed to do injustice on the other side; and it is only after a series of oscillations in public opinion that the true state of the case becomes generally known and acquiesced in.

With reference to the second proposition, we may state, that so important an element is the state of public intelligence in regard to the success of an invention, that many of the most important processes of art have been more the result of the actual spirit and want of the age than the product of the ingenuity and knowledge of an individual; and in such cases the invention is frequently brought forth simultaneously by a number of different individuals. The art of printing may be placed in this category. At a certain period in the history of the world, this invention was loudly called for by the pressing necessities and peculiarities of the times. It was then produced; but had the attempt been made at an earlier date to introduce it, the result would probably have been a failure. We have a similar example in the application of steam to navigation. The world had, for years before this invention, been in possession of the steam engine, and a boat had even been propelled by steam on the Clyde, in Great Britain, but the invention was not appreciated. Neither the time nor the place were favorable to its introduction; and it was reserved for our country, with its immense plexus of navigable rivers, and its broad expanse of internal lakes, to call for this addition to the art of locomotion, and for the genius of Fulton to give a successful response. Even in this case the importance of the invention was so manifest, and its means of attainment so simple, that several competitors contended for the prize; and had any accident happened to retard for a few weeks the completion of Fulton's first boat, he would have been anticipated in the result of his enterprise by the fortunate experiment of the elder Stevens. In making this statement, I would not wish to detract from the real merit of individuals; they have sufficient claims for remuneration and reputation in being among the first to appreciate properly the value of the improvement, and to avail themselves, at the earliest point of time, of the necessary means of accomplishing it. I may remark, in passing, that, from the foregoing views and statements, it is plain that the steamboat is emphatically an American invention. It was in this country that premiums were first offered for its production, and on the Hudson, in 1807, it was first reduced to practice. It was not adopted in England until 1812, and not until 1816 in France.

From a want of a knowledge of the state of science, and a due consideration of the proper time and place, many ingenious minds have wasted their energies in fruitless labor, waged with fortune an unequal war, and sunk into the grave the victims of disappointed hopes. Such men are frequently said to "live before their time;" but it remains to be proved whether, in the aggregate of cases, they have done more *good* or *evil*, and whether they most deserve our *admiration* or our *pity*. A premature, and, consequently, an unsuccessful attempt, often so prejudices the public mind against an invention, that, when the proper time actually arrives for its introduction, public sentiment is found arrayed against it, and difficulties have to be overcome which would not have existed had the first essay never been made.

The man of true genius never lives before his time; he never undertakes impossibilities, and always embarks in his enterprise at the suitable place and period. Though he may catch a glimpse of the coming light as it gilds the mountain top, long before it has reached the eyes of his contemporaries, and though he may hazard a prediction as to the future, he *acts* with the present.

There are some partial exceptions to this rule, and among them I would mention, with high respect, that of Oliver Evans, than whom no man in this country has ever done more to improve the art of locomotion. He, indeed, predicted that steam wagons would be used on common roads, and made attempts to reduce his idea to practice. The time, however, for the introduction of this invention has not even *yet* arrived, and at present we see no prospect of its coming. But he was more successful in the invention of the American high-pressure engine, which was so essential to the development of the vast resources of the interior regions of our continent. This engine was, at the time of its introduction, admirably adapted, in its cheapness, simplicity of arrangement, smallness of dimensions, and great power, to the abundance of fuel, the extent of transportation, and the primitive state of the arts in our country. The low-pressure engine used by Fulton was procured from England; and had steam navigation been confined to the employment of the complex and expensive machines of this class, the Mississippi and its tributaries would have remained for years unnavigated, except by the canoe of the native or the flat-boat of the pioneer.

The invention and introduction of the high-pressure engine required the application of genius, energy, and courage. The use of high steam had been proposed in England, but had been discarded on account of the supposed danger attendant on its use, and it was reserved for this country to demonstrate its practical importance. Without precursory labors equivalent to those of Evans, the present railway locomotive would not have been in existence.

It gives me pleasure to pay this passing tribute to the memory of one to whom our country owes so deep a debt of gratitude, and whose name deserves a more conspicuous place than it now holds in the history of American inventions.

Every age of the world, since the commencement of the historic period, has been characterized by some leading or dominant idea; and each age has bequeathed something of value to, or made some abiding impression on, that which followed.

The great characteristic of the present time is the application of science to art, or, in other words, the developement of the inventive faculty of the human mind. The last century was equally if not more fertile in the discovery of the great principles of nature from which we are now reaping so rich a harvest of practical results, but a knowledge of these was not then so interwoven with the thoughts of the common mind as to render them available for purposes of art. Indeed the facts and elementary principles of science as well as the application of the rules which have been deduced from its higher generalizations, are now so familiar that art has become vain of her attainments, has set herself up as the architect of her own fortune, and disregards the counsel of her more learned and sagacious sister. Such a course, however, is usually accompanied with its own punishment. The new edifices, designed by empiricism, are generally unstable structures, and most frequently involve the ruin of the builder in their fall.

It is true many valuable inventions have been founded on the accidental discovery of simple facts; but such inventions can never be perfected, unless the principles of science, on which they are based, are known. It is also true, that many arts may be successfully practiced by persons entirely ignorant of the principles of these arts. We have a notable example of this in the art of navigation, and in many of the processes of engineering. The practical man, in these cases, employs rules and deductions furnished by abstract science, in the application of which, he often becomes more expert than the original author. But sure progress in art cannot be obtained without anterior or cotemporaneous progress in science. The inventor, to insure his success, must consult the discoverer, and the practical skill of the one be directed by the theoretical knowledge of the other.

After what has been said in different parts of this address, it may be superfluous to give a formal definition of discovery and invention; but these terms are so frequently confounded with each other, and their misuse so much connected with error, that it is necessary they should be clearly defined, even at the risk of prolixity.

By a *discovery* in science is understood the development of a knowledge of the existence of some principle in nature not before known or but partially understood; while the term *invention* indicates the application of this knowledge either simply or in combination with other knowledge to some useful purpose in the arts. For example, Franklin *discovered* the principle of electrical *induction*, or the action at a distance of a charged body on a conductor, and on this founded his *invention* of the lightning rod.

It sometimes happens that the peculiar characteristic of mind and training, necessary to the successful prosecution of these two branches of labor, are found combined in the same individual. Of a happy combination of this kind, James Watt affords a striking example, the like of which will become more common in proportion as the means of intellectual improvement afforded to workmen, are extended. Generally, however, the two faculties exist in the greatest degree of development in seperate individuals. The successful investigation of a new principle in science, generally requires much previous study and preparation, and a logical training which few men, however vigorous may be their native intellect can dispense with, and to acquire which, the opportunities of the workmen are inadequate. On the other hand, the successful introduction to common use of an invention, requires a contest with the world, from which the sensitive student of abstract science shrinks with repugnance. I consider these remarks of some importance, because in this country where there is so great a demand for immediate practical results the value of labor in the line of abstract science is not properly appreciated or encouraged.

We have said that every age of the world has bequeathed something of value to that which followed, and we may add that it is doubtful whether any great truth has ever been lost; though some may have apparently lain dormant for a time, yet they have continually produced results. Some arts have undoubtedly fallen into disuse, because they are no longer required, or because they have been superseded by more perfect processes. We, however, think it can be clearly established that modern science is capable of reproducing every invention of ancient art, and at an indefinite economy of human time and human labor.

I know we are frequently referred to the immense masses of stone transported and wrought by ancient art, which are found among the ruins of Balbec and Thebes, and are frequently told that the management of these would far transcend the skill and power of modern engineers. Such assertions are, however, rather intended to convey an idea of the impression produced upon the beholder of these venerable ruins than a declaration of absolute truth. As a sufficient illustration of this, we may mention the fact that, in New York, large buildings of brick and stone are moved from place to place, while the inhabitants remain undisturbed within. Or we may point to the Menai strait tubular bridge, a structure of cast-iron several hundred tons in weight, suspended in mid air over a chasm more than a hundred feet deep.

The pyramid of Cheops is said to have employed the power of 100,000 men for twenty years in its erection. But, vast as is this pile, were the steam engines employed in one of our large cities directed to the task of rearing one of equal magnitude, the whole would be accomplished in a few weeks.

I have said that no arts of importance have been lost, but perhaps this assertion is rather too general. There is one which may be considered an exception—I allude to the ancient art possessed by the few of enslaving and brutalizing the many—the art by which a single individual, invested with the magic of kingly power, was enabled to compel thousands of his subjects, through the course of a long reign, like beasts of burden, to haul materials and heap up huge piles of stone, which might transmit to posterity the fact that a worm like himself had lived and died. The pyramids of Egypt, venerable as they are with the age of accumulated centuries, are melancholy monuments of human degradation, of human vanity and cruelty.

There are certain processes of thought which require individual exertion rather than combined effort for their development. There are certain arts in which perfection depends on the genius and skill of the individual rather than on the condition of the race. Such are oratory, poetry, painting, and sculpture. In these, if an individual excel, he excels for himself—his skill is not transferable, though his example may serve to awaken the same taste in many of his contemporaries and successors. For the development of these arts, the individualism of the Greeks was well adapted, and they were accordingly advanced by this people almost, if not quite, to their maximum state of perfection.

The result of the labors of the ancients in the development of the beautiful have not been lost; on the contrary, they will ever remain impressed upon the human mind. The marble of the Parthenon may be reduced to atoms, and these scattered to the winds of Heaven, but its form is imperishable. The moderns do not excel the examples of the fine arts bequeathed to them by the ancients, because it would be idle to attempt to add to that which is perfect, to gild refined gold, or paint the lily. But they have invented tools and processes by which copies of these precious relics may be multiplied indefinitely, with unerring precision, by the application, not of manual skill, but of physical labor.

This union of the industrial with the fine arts vastly enlarges the influence of the latter, and enables them to be appreciated, and genius to be admired by millions whom their single productions would never reach. There are at this time more minds enthusiastically alive to the beauty of ancient art than there were in the days of Phidias. Nothing, then, of importance with reference to art has been lost, but, on the contrary, much has been gained.

In these remarks I seek not to disparage the past, nor to unduly exalt the present. The character of the world, as it now exhibits itself in its mental and moral development, its knowledge of Nature, and its skill in Arts, is the result of all the impressions made on it from the earliest dawn of civilization to our own day. In the case of an individual, every impression to which his mind is subjected, either from external nature or his own mental operations, or those of his fellow men, produces an indelible effect, modifying all the previous impressions, and co-operating with them to form the peculiarities of his mental and moral character. An analogous effect is produced on the whole human family during the ages successive of its existence.

By these remarks we do not wish to draw upon ourselves the imputation of advocating the inevitable progress of the human race. The world is subject to evil impressions as well as good, and whatever advance is made in the line of true progress, will not be the result of a blind law of necessity, but of a providential design through human agency and properly directed human labor. Without labor, nothing of value can be accomplished. It is the essential pre-requisite of well-being, the original curse which proves a blessing in disguise. The remark has been properly made, that could all the wants of man be supplied without labor, there would be more reason to fear that he would become a brute for the want of something to do, rather than a philosopher from an abundance of leisure. In all countries where nature does the most, man does the least. The sterile soil and the inclement sky, seem as the stimulants to mental and physical exertion, when once the necessary impulse has been given. True progress does not consist in obviating the necessity of labor, but in changing by means of improvement in the arts, its character in rendering it more conducive to the supply of the wants and comforts of man, and to the development of his mental and moral nature.

We have received from the past a rich treasure of knowledge, the product of the body and mind, gathered under difficulties and danger, and improved by the thought and the experience of years. Our great object should be to purify this knowledge from error, to reduce it to its essential and simple elements, and to transmit it with the greatest amount of new truth to our successors. We should, however, recollect, that accumulated knowledge, like accumulated capital, increases at compound interest, and that therefore each generation is bound to add much more largely to the common stock than that which immediately preceded it. It is the high privilege, as well as the sacred duty, of every one of us to labor for the improvement of ourselves and our fellow men, and to endeavor, to the utmost of our ability, to leave the world at least a little wiser and better than we found it. But, in order to success in this effort, we must cultivate other provinces of thought, than merely those which belong exclusively to the development of our knowledge of the external world. There are other regions of a higher and holier nature, without the cultivation of which no true progress can be made.